State of North Dakota
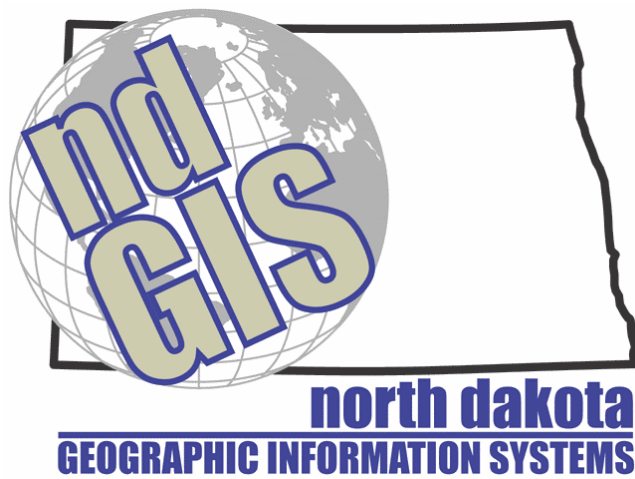
GIS Initiative Strategic Plan - 2008

Prepared By: Bob Nutsch
            GIS Coordinator
            Information Technology Department

Contents

1. EXECUTIVE SUMMARY

This Strategic Plan for the GIS Initiative was developed by the GIS Technical Committee (GISTC) through a collaborative process and is updated and monitored on a regular basis. The GIS Initiative is driven by the GISTC with the focus of the work being the development and maintenance of the GIS Hub which is funded by the North Dakota Legislature and is the foundation of the GIS Initiative. The GIS Hub is a database and web infrastructure utilized by state agencies and the public for interactive mapping, data downloading, data searching, and data distribution.

In addition to the continued operation and development of the GIS Hub, the GISTC provides the coordination for state agency GIS activities, data development, and interaction with local and federal government. Sufficient funding and personnel resources continue to be a challenge with these coordination priorities.
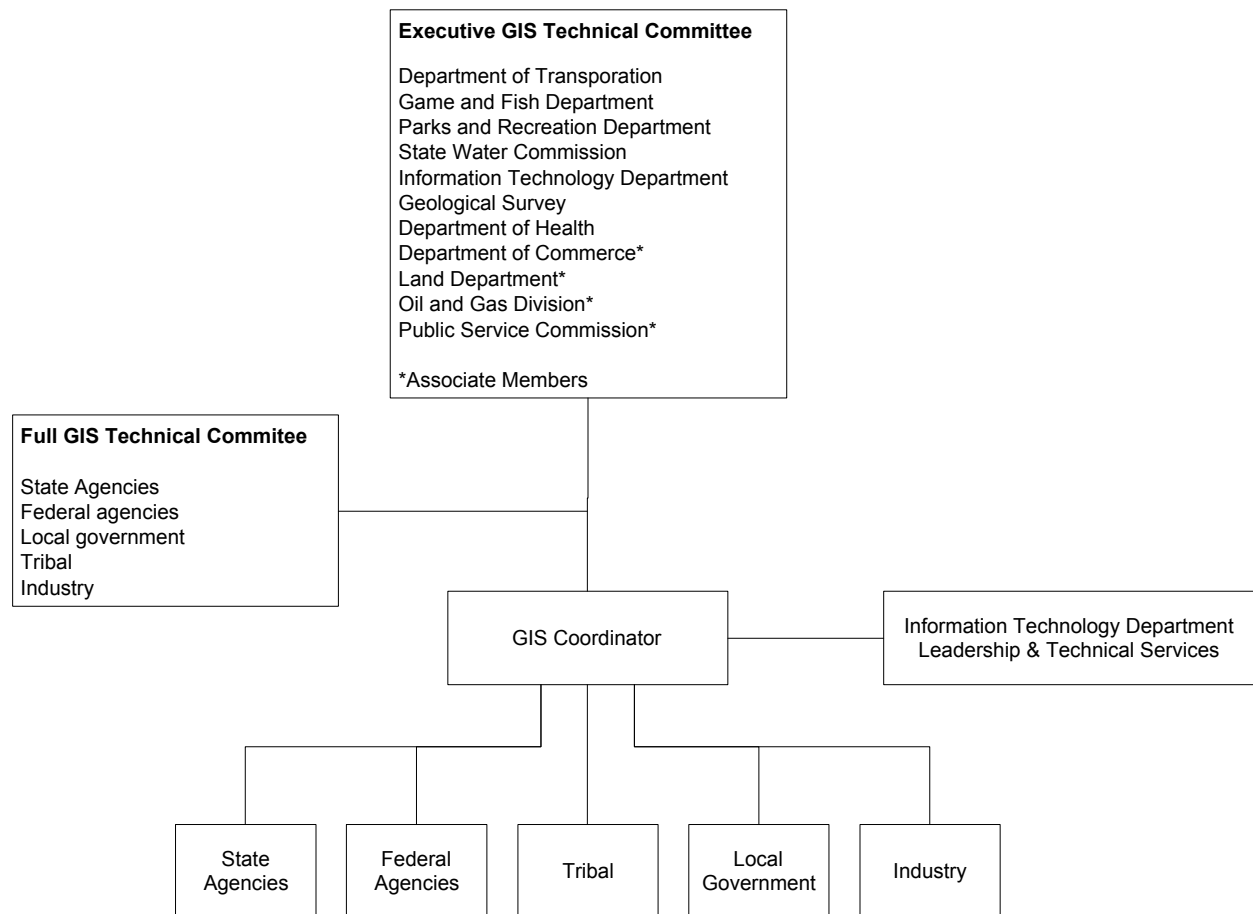
The business case for the continuation of the GIS Initiative includes the role of the GIS Hub in economic development, efficient delivery of geospatial data to the public, compliance with federal initiatives and best practices, cost avoidance and cost savings, and the leveraging of skills and expertise from state agency personnel.

The top goal included in this Strategic Plan is the continued enhancement and development of GIS data. Without quality and current data, the delivery mechanisms for that data and the decisions based on that data are irrelevant. The state agencies must work together and prioritize the State's data needs, and work with other levels of government and the private sector to develop, maintain, and fund prioritized data.

A broad level of support for continuation and growth of the GIS Initiative is needed from state agency leadership, the Governor's office, and the Legislature. The GISTC will be working to increase this support and knowledge of the importance of GIS within state government. This is critical for state government leadership during times when budgetary decisions are being made.

2. CURRENT SITUATION

2.1 Who We Are

Executive GIS Technical Committee

Department of Transporation
Game and Fish Department
Parks and Recreation Department
State Water Commission
Information Technology Department
Geological Survey
Department of Health
Department of Commerce*
Land Department*
Oil and Gas Division*
Public Service Commission*

*Associate Members

Full GIS Technical Commitee

State Agencies
Federal agencies
Local government
Tribal
Industry

GIS Coordinator

Information Technology Department
Leadership & Technical Services

State Agencies	Federal Agencies	Tribal	Local Government	Industry

2.2 Mission Statement

The State of North Dakota's GIS Hub will provide the essential infrastructure to share core geographic datasets through an accessible data warehouse among stakeholders with browsing ability to the general public. The Hub will leverage the State's existing data, infrastructure and expertise to implement the core elements of this enterprise solution.

2.3 Accomplishments

Previous Bienniums (spanning 2001-2005)

- GIS Hub goes into production
- Special Achievement in GIS award from ESRI to the GISTC

- U.S. Geological Survey grant for sharing GIS Hub data with The National Map
- Free GIS software for all K-12+ schools
- Annual GIS Users conferences begin
- New agency-driven GIS applications

2005-2007 Biennium

- Development of the first GIS Initiative Strategic Plan
- GIS Professional Services Contract Pool allowing for structured work order process
- Record GIS Users conference attendance (2006)
- New agency-driven applications
- Record use of GIS Hub web services (March 2007)
- Added four associate member agencies to the GISTC
- Coordinated training has saved state agencies over $65,000 in training costs alone

2.4 Where are we now?

The GIS Technical Committee (GISTC) was established by Executive Order 1995-05 and reaffirmed with Executive Order 2001-06. The GISTC meets monthly and consists of eleven state agencies, four of which are non-voting associate members. The associate members provide additional guidance and agency insight to the GISTC; their addition reflects the growing use of GIS within the state agencies. The "full" GISTC consists of all other interested state, local, federal, tribal, and the private sector and meets annually.

The core of the GIS Initiative is the GIS. The GIS Hub is a database and web infrastructure utilized by state agencies and the public. The web infrastructure provides interactive mapping, data downloading, data searching, and streaming of data via web services.

The GIS Hub consists of ArcSDE/Oracle running on a dedicated GIS Sun server (Solaris) and ArcIMS running on two dedicated GIS Windows/Intel servers. FME runs on a single dedicated Windows/Intel Server. The ArcIMS and Spatial Direct web services utilize shared IBM HTTP web servers (Red Hat Linux) and shared IBM WebSphere 5.x application servers (Red Hat Linux). All servers are hosted by the Information Technology Department.

Data is stored on a Storage Area Network (SAN) with three storage tiers from which to choose (Gold, Silver, Bronze), each associated with a cost and service level objectives. On the one Sun server, there are six instances of Oracle/ArcSDE, with four of those being production and two of them test. One of those instances is set up to store agency-managed data, where agencies create/edit/delete their data as they require and with the agency specifying who has rights to that data.

Approximately fifteen agency-driven interactive web mapping applications are hosted on the GIS Hub. ESRI-format image and feature services, OGC-format WMS services, geocoding

services, and metadata services are also part of the GIS Hub. Data downloading is available via a customized order form or standard file server.

Data on the GIS Hub can originate from local, state, tribal, and federal sources. Of the approximate 180 layers on the GIS Hub, each one is assigned a data steward. Data stewards are responsible for maintaining the data locally and ensuring it is loaded onto the GIS Hub. Before loading the data into production, the Data Oversight Committee, consisting of a subset of the GISTC membership, reviews the data.

In May 2007, approximately 3.8 terabytes of storage was allocated to the GIS Hub. During 2006, the GIS Hub averaged 35 daily concurrent database connections, nearly 32,000 data downloads (about 4.2 terabytes), and totaled over one million hits on the web services.

2.5 Strengths, Challenges, Opportunities

2.5.1 Strengths

The GIS Initiative is driven by the GIS Technical Committee (GISTC) which consists of 7 agencies and 4 associate member agencies. Executive Order 2001-06 provides the membership and mandate of the GISTC.

The GISTC meets on a monthly basis, rotating the meeting locations between each of the agencies. GIS expertise at the state agencies are shared at these meetings and is used to help develop and manage the GIS Hub and its data and applications.

The GISTC is an independent working group that reports to agency and commission directors through individual GISTC members and through annual update meetings. In addition, comments, suggestions, and direction from the GISTC are transmitted to the Information Technology Department (ITD) via the GIS Coordinator. ITD hosts the GIS Hub infrastructure and provides hardware, software, and development staff and support as needed.

General funding from the Legislature is used to maintain and develop the GIS Hub and some data development. The GIS Hub funding is part of the ITD budget.

In May 2004 the National States Geographic Information Council (NSGIC, see www.nsgic.org for more information) released a set of criteria for effective statewide GIS coordination (http://www.nsgic.org/states/statemodel_git.pdf). These criteria are now part of the Fifty States Initiative. North Dakota currently meets 8 of the 9 criteria. Item 5, "Responsibilities for developing the National Spatial Data Infrastructure and a State Clearinghouse are assigned," is currently only partially met as the GISTC has not yet clearly defined what the NSDI responsibilities are.

2.5.2 Challenges

General challenges for the GIS Initiative include continued and expanded funding from the legislature. Continued funding is needed for operational activities and expanded funding is

required to enhance and grow the GIS Hub, namely data development and application development and replacement. One of the biggest areas of concern is the cost of data storage where if left as is, the GISTC may be able to acquire additional data but not be able to store it. Another area of concern is having sufficient resources for application development which includes replacement of aging tools and researching new tools and methods. Without replacement of aging applications and not keeping up with new technology, future expenditures may be much larger when upgrading.

Individuals from state agencies have been very active in data development and maintenance activities since the inception of the GIS Hub. Their work in data and in other activities associated with the GIS Initiative can conflict with their primary agency-related work duties. As a result, GISTC schedules can and will be impacted. However, the ND GIS Hub was founded based upon the combined work of the agencies that are involved and this model represents the best possible approach, as the agencies are the primary users and developers of most of the data that resides on the ND GIS Hub.

The GISTC recognizes that there is an overall lack of statewide GIS coordination between counties. The adoption and use of common standards, up-to-date training, and the development of statewide projects, and counties just starting out with GIS would benefit with statewide county coordination.

Statewide data collection efforts in which local and tribal government will play a key role and that are in their infancy or yet to be started include road centerlines and land parcels. Issues that are related to these efforts such as standards, maintenance, compilation, and work flow need to be resolved using the limited financial and people resources available. However, what is learned and the relationships gained during these data collection activities will be directly applicable to national initiatives such as Imagery For The Nation (http://www.nsgic.org/hottopics/imageryforthenation.cfm)

Accommodating future growth of GIS data and applications, both on the GIS Hub and within the agencies can be a challenge due to the complexity of GIS and associated business functions. Often agency business functions rely on third-party extensions that need to be upgraded by the third party provider. These schedules are beyond the control of the agency and the GISTC. However, since many of these types of third-party extensions are essential to agency business operations, they may delay the update of the GIS Hub to the latest version. Sequencing upgrades of new versions of GIS software used on the desktop within the agencies and on the GIS Hub is an issue raised every time there is a new software release. Even though new versions of the GIS software commonly also bring in new functionality, extensive testing must be completed by the agencies before the new software can be put in place at the agency or on the GIS Hub without disrupting the day-to-day usage of the GIS Hub.

Open Source GIS tools are becoming more prevalent throughout the world and in certain areas can meet or exceed commercial offerings. Some local governments are already using Open Source GIS software and at least one state agency, the State Water Commission, is using it. Transitioning to Open Source GIS tools, in particular server products may present some new challenges within current enterprise strategies. The use of Open Source GIS tools may be more

appropriate for some state agencies and this may drive the deployment of server tools onto the GIS Hub.

2.5.3 Opportunities

Leveraging the strengths of the GIS Initiative and realizing the challenges, the GISTC believes there are a number of opportunities that would benefit state, local, and tribal government by these groups working together:

- Road centerlines and property parcels – The GISTC should help local government entities which are the data stewards by assisting in the development of standards and data maintenance workflow. One of the challenges for data maintenance is the opening up of the GIS Hub for the data stewards to upload and distribute their data. The GISTC recognizes that there may be security concerns that need addressed.
- High-resolution aerial photography – The state should work more closely with local and tribal government to define priority areas, update frequency, and funding mechanisms.
- Statewide aerial photography – North Dakota is one of several states that until 2010 will no longer have statewide photography done as part of the National Agriculture Imagery Program (NAIP). This data is extremely useful and popular. Multiple funding partners including those from the private sector could collaborate to provide partial funding with the remainder coming from federal sources to enable NAIP collection in 2008.

2.6 Business Case

The success of the GIS Initiative, which includes the accompanying success and usage of the GIS Hub, will enhancement the image of the state to the public and government organizations through:

- Economic development applications and data
- Efficient delivery of geospatial data to the public
- Compliance with federal regulations, requirements, and best practices

With the GIS Hub in place and being the centralized infrastructure for storing and disseminating geospatial data, and with the coordination provided by the GISTC, cost savings will be realized through:

- Coordination of vendor training
- Labor savings associated with creating, compiling, and transforming project data
- Application standardization and code re-use
- Coordination of application development activities
- Reduced project start-up costs

Through coordination by the GISTC and leveraging the GIS Hub infrastructure, future costs will be avoided through:

- Leveraging skills and expertise from personnel of state agencies
- Elimination of application development and data redundancies

- Application development/platform re-use opportunities

3. VISION AND GOALS

3.1 Vision Statement

It is the vision of the GISTC that the GIS Initiative will continue to grow in value to state agencies and other levels of government which in turn increases the level of service and cost effectiveness to the citizens of the North Dakota. The core of the GIS Initiative is the GIS Hub which will continue to develop through a focus on improved and new data sets and secondarily, through improved and new functionality and applications.

3.2 Strategic Goals and Objectives: 2007-2009

Nine goals have been identified by the GISTC to implement its vision and achieve its mission; they are listed in order of importance. The GISTC will focus its efforts on the needs of North Dakota state government, but will also strive to align its goals with that of the NSDI and to use the Fifty States Initiative as an overall guide. The GISTC is aware of the need to build the National Spatial Data Infrastructure (NSDI) which "assures that spatial data from multiple sources (federal, state, local, and tribal governments, academia, and the private sector) are available and easily integrated" (http://www.whitehouse.gov/omb/circulars/a016/a016_rev.html). The GISTC acknowledges the Fifty States Initiative which defines the criteria, characteristics, and activities that identify effective state coordination councils who are working with other levels of government to build the NSDI (http://www.nsgic.org/committees/documents/fifty_states_initiative.pdf).

Goal 1 – Continued enhancement and development of GIS data. Improve existing data sets, and after identifying desired data sets, develop plans to acquire that data.

Objectives
- Define maintenance schedule of existing data
- As required, provide support for the NSGIC Imagery for the Nation program
- Increased storage capacity at lower cost
- Encourage development of sound methodologies and plans for acquisition of spatial data.
- Review & prioritize framework data sets to be improved and developed; adopt FGDC currency and accuracy guidelines for framework data
- Acquire NAIP aerial photography or equivalent statewide imagery – county mosaics for all years and raw data every other year, budget permitting
- Acquire local and regional high-resolution aerial photography as it becomes available
- Focus on key data development and improvement needs: road centerlines, cadastral, improved DEMs, geodetic, flood map data, improved PLSS, hydrologic unit delineation,

aquifer compilation, utilities, railroads, critical infrastructure, updated wetlands, vector landuse/landcover

Goal 2 – *Improved statewide GIS coordination.* Streamline the flow of data, ideas, and priorities within the state at all levels of government, the academic sector, the private sector, and the public.

Objectives
- Maintain and promote the GIS Professional Services Vendor Contract Pool
- Develop and provide an annual "Executive GIS Update" meeting
- Develop an upgraded GIS Initiative brochure
- Explore the need to develop and implement a statewide GIS coordination model

Goal 3 – *Outreach GIS.* Promote the exchange of data, ideas, activities, standards, and technologies at tribal, county, city, federal, and higher education levels.

Objectives
- Continue to assist in the GIS in K-12 program
- Promote and grow the GIS Users Conference. To keep the conference fresh and useful, consider changing the schedule to be every other year and consider other hosting venues and/or other hosting organizations.
- Continue the existing partnerships and pursue new opportunities with the federal government, which include The National Map, the NSDI, and the Geospatial One-Stop
- Explore the development of Memorandums of Understanding with local and federal government entities regarding data sharing and development

Goal 4 – *Promote GIS training.* Continue and expand GIS education opportunities. While the focus of this effort is state agencies, these opportunities are open to other entities.

Objectives
- Continuation of coordinated GIS training to keep abreast of changes in GIS technology
- Conference grant program to facilitate training of GISTC member agencies
- Develop customized training classes

Goal 5 – *Improved GIS Standards.* Designed to assist in sharing of data and to serve as a guide for new projects, and in accordance with goals of the NSDI, these standards would be developed in partnership with local government.

Objectives
- Develop standards such as those for address, road centerline, and parcels, with a focus on attributes and spatial accuracy. Monitor and maintain data content standards with respect to national standards.

- Ensure metadata consistency across data sets, in particular, field and domain definitions.

Goal 6 – Improved GIS data distribution. Provide enhanced means of distributing vector and raster data through the GIS Hub.

Objectives
- Merge ND Geological Survey clearinghouse with the GIS Hub
- Deploy Oracle project instances for agencies as needed
- Deploy ArcSDE replication to share data between agencies and the GIS Hub
- Investigate/deploy Image Server as a means to more quickly bring data on line
- Improve the Metadata Explorer or similar tool to include the ability for people to upload their metadata
- Develop ability to download raster data, similar to what is available for the vector data.
- Study using a defined projection to improve storage accuracy and usability

Goal 7 – Implement greater levels of open source GIS. Open source GIS represents a rapidly growing sector of geospatial technologies. The state needs to continue to monitor open source tools and to regularly review its applicability to state and local government.

Objectives
- Continue to improve and enhance existing OGC (Open Geospatial Consortium) implementations
- Implement OGC WFS (Web Feature Service), Z3950
- Continue to monitor the development of open source server and desktop tools and their applicability to state government

Goal 8 – Promote view of geographic information as critical information asset. Geographic information is critical in emergency preparation and mitigation. Because GIS data is costly to develop and maintain, it should be protected in case of power failure, fire, flood, etc.

Objectives
- Define critical applications and data sets. These may be on more secure hosting systems
- Develop service level objectives – a current level of service along with what can be expected. Include data storage types, database, and web services
- Investigate disaster recovery of critical data sets, this could include replication of data to the second data center or other location, off-site storage. Identify mission-critical data sets that require redundancy and mirroring of data at alternate sites
- Develop a second ArcSDE server to be used for failover

Goal 9 – Improved reliability and access of GIS Hub systems. Enhance the GIS Hub systems to provider greater reliability and enhanced accessibility to state agency users.

Objectives
- Further develop the Hub Explorer and the Metadata Explorer with new functionality as needed
- Develop a GIS Hub data model for all primary data sets
- Development of Internet Mapping Framework (IMF) as possible replacement to Hub Explorer template.
- Conversion from ArcIMS to ArcGIS Server as needed

3.3 Strategic Goals and Objectives: 2009-2011

The goals for the 2009-2011 Biennium remain the same as for the 2007-2009 Biennium. The primary 2009-2011 objectives include the continued enhancement of framework data, the improvement of statewide GIS coordination, the extension of accessibility of existing data within the ND GIS Hub, and more agency involvement with the GIS Hub.

4. REQUIREMENTS FOR OBJECTIVES

4.1 Organizational Needs

One of the key needs of the GIS Initiative is budgetary support at the highest levels of state government. Agency executives need to uniformly know what the GIS Initiative has done for their agency and the state and where the GIS Initiative is going. The GISTC needs to provide at least an annual "Executive GIS Update" for department heads and elected officials to avoid any mis-understandings or doubt regarding the needs and goals of the GIS Initiative. In turn, the GISTC needs to have sufficient budgetary support from the agencies and the Governor's Office prior to entering a legislative session.

A reduction in storage cost is a mission-critical item to allow new and improved data sets to be stored on the GIS Hub. The GISTC is leading the way in state government to develop with ITD a fourth tier of storage in which the storage is purchased up front and then an administration fee is paid on a monthly basis. This new storage model needs to be fully endorsed by ITD for applications such as the GIS Hub that have large data sets that change infrequently.

Sufficient staffing for the support and development is required for optimal growth of the GIS Hub. An additional person would improve response time to agency requests for application maintenance and development, conduct research and development on new or evolving GIS technologies, implement GIS Hub upgrades, and load new and updated data. The GISTC agencies believe that the GIS Professional Services Contract Pool can be used as a means to grow the GIS Hub with limited resources.

Specific agency needs vary but common themes include continued, open access to data and continual updating of existing data.

4.2 Budget

GIS Budget	2005-07 Requested	2005-07 Appropriated	2007-09 Requested	2007-09 Appropriated
Total Ongoing Operational Costs	$515,084	$503,784	$703,288	$563,828
Total Implementation & One-time Costs	$488,259	$183,196	$234,172	$225,321
Total:	$1,003,343	$686,980	$937,460	$789,149

Note that increased operational costs are due largely to application hosting, data storage, and GIS Hub development. Increased implementation cost is due to data development.

5. IMPLEMENTATION

5.1 Marketing the GIS Initiative

With the proper resources, the GIS Initiative will remain stable and will grow as long as it is capable of providing the agencies the necessary tool base to meet their business functions. However, the GIS Initiative requires support from many different areas because funding for the development of the ND GIS Hub supports and is peripherally supported by the agencies. Therefore, it is important to keep the executive agency leadership and the legislature informed of the inter-relationships between the ND GIS Hub and agency GIS operations so that proper funding can be maintained. In order to provide the necessary information the following steps will be taken:

- Provide an annual "Executive GIS Update" meeting to inform senior agency leadership and elected officials of the activities, direction, and needs of the GIS Initiative. One of the goals of these meetings would be to develop champions of the GIS Initiatives. One of these meetings would precede the beginning of the budgetary cycle to ensure that GIS budget needs are well known and understood.
- Develop an updated GIS Initiative brochure to be distributed to legislators, agencies, and the public.
- Continue working with local and tribal government organizations and the private sector, giving them a better understanding of the capabilities of the GIS Hub. Implement new functionality and improve existing as suggested by governmental users of the GIS Hub to further their support for continuation of the GIS Hub.

- The GIS Coordinator will provide an update on GIS Initiative activities, direction, and needs to the State Information Technology Advisory Committee (SITAC) on a frequent basis.

5.2 Budget

The GIS Initiative budget supports the goals and activities as set forth by the GISTC. This budget supports both on-going operational expenses such as the fees paid to ITD for hosting servers, applications, and applications, for basic maintenance activities, and for annual licensing fees. The budget also supports one-time implementation costs such as the purchase of new software, development of new applications, and data development.

The amount set aside for data development is typically a small amount compared to the total cost of developing any given data set. For this reason, the data development budget is restricted to a) purchasing or developing relatively inexpensive data sets that will have wide-spread use amongst the state agencies and b) as collaborative money to be used with other contributors. Examples of collaborative data development include local or regional high-resolution imagery and important statewide data sets such as road centerlines.

The GISTC will be challenged to work with local and tribal government who wish to make their data available on a statewide basis. We are not stewards of their data but we will assist in developing standards and promoting the distribution of this data via the GIS Hub.

5.3 Technology Upgrades

To remain useful and viable, periodic reviews of the GIS Hub infrastructure and workflow are necessary. The GISTC foresees the need to bring in the vendor(s) of the software used on the GIS Hub on a regular but infrequent basis to review the current status, make recommendations, and implement upgrades.

The GISTC will make use of the GIS Professional Services Contract pool to implement upgrades and enhancements to the GIS Hub infrastructure and agency GIS applications hosted on the GIS Hub due to limitations in available staff within ITD.

6. FUTURE STATE

6.1 Application and Data Hosting

The current funding model of the GIS Initiative has remained unchanged since the funding began with the 2001-2002 Biennium. This model states that overall cost to implement state level GIS is less expensive by centralizing core data storage components to provide seamless access to a central spatial data store. In this model, General Funds appropriated by the State Legislature will ensure sufficient and continued capacity for hosting data. This model makes it relatively

easy for any state agency to access the spatial data, which is one of the most costly components of any GIS application.

The downside to the current model is that based on legislative funding, there is a set capacity on the GIS Hub. There is potential for an agency's data storage needs to consume all free capacity on the GIS Hub at the expense of other state agencies with existing or planned GIS Hub deployments. This could put the GISTC into a difficult situation, having to choose which data to host while the GISTC waits to get further funding from the Legislature to increase capacity.

The GISTC is currently working with ITD to provide additional storage solutions that are much more acceptable for GIS applications. If successful, this new storage tier will go a long ways toward mitigating this problem as it will provide a much more cost-effective tier of storage that is easier to budget. This tier also provides greater flexibility for agency participation to provide expansion between budget cycles.

The GISTC is in the early stages of discussing how to best manage the growth of the data, services, and applications on the GIS Hub. There may be a need for agencies to pay a fee for some data hosting if that data is specific to an agency and is not shared with other agencies. GIS Hub applications have yet to be defined but they may be those browser-based tools having some level of functionality for map navigation and query tools. These applications generally rely on one or more data services which provide data (typically maps) and geoprocesses. Agencies might pay a fee for their web-based application but the data services would be free.

This approach, if taken, would have the GIS Hub as being data-centric with hosting of multi-purpose data and services at no cost to the agencies. Agencies would pay for hosting of their GIS web applications, as they do now with their static web sites. If this approach is taken, the GISTC would have to ensure that the openness and flexibility of the GIS Hub is maximized. In fact, by separating the applications from the data services, the GIS Hub will become more open to both commercial and open source GIS software by offering clearly defined API's by which other systems can interact with GIS Hub data. These API's might also lessen the possibility of version dependencies within one software suite between data sources and applications.

6.2 Disaster Recovery

As the GIS Hub continues to grow and agencies incorporate GIS into their business plans and needs, there will be a time when applications and data become mission-critical. The GISTC will need to periodically review what is on the GIS Hub and when needed, begin to build an infrastructure that supports disaster recovery, ranging from accidental deletion of a dataset to providing support to agencies in times of man-made or natural disaster.

Off-site data storage and application hosting needs to be developed as needed, with appropriate funding from the legislature through an increased GIS budget. Off-site data and applications could potentially be hosted by North Dakota's second data center or by a regional organization that provides such a service.

6.3 Technology

Open Source GIS Software

The GISTC acknowledges that open source GIS server and desktop technology are experiencing rapid growth. North Dakota state agencies may find it advantageous to utilize this technology within their business applications. This already has been done at the State Water Commission. .

The GISTC should position itself to support state agency open source GIS activities as a whole. One example includes the continued monitoring of the status and cost effectiveness of open source GIS server and desktop technology and how it could apply to the GIS Hub and users of the GIS Hub. Another example is the potential to fund enhancements to particular open source software tools that have general applicability to state agencies.

In the future, more of the GIS Hub web services will be in Open Geospatial Consortium (OGC) format, both WMS and WFS. Currently WMS is provided using ArcIMS. WFS will be made available in the near future. There is the possibility of investigating the use of WPS (Web Processing Services) and WCS (Web Coverage Services) to deliver geospatial content and services.

Commercial GIS Software

Image Server may provide a significant savings for storing and delivering imagery compared to ArcSDE. The GISTC will need to conduct testing to determine how this tool would apply to the GIS Hub and its users.

Beginning with version 9.3, ESRI plans to support running ArcSDE on PostgreSQL. The GISTC will follow these developments and evaluate the implications (administration, support, performance, cost) of converting from Oracle.

New and upgraded functionality such as replication, versioning, and multiple project instances within ArcSDE, now known as ArcGIS server Replication, will play a role in the future GIS Hub. These tools are required in order for state agencies to more effectively manage their own data and where appropriate, share their data with other agencies and to the public.

7. APPENDICES

7.1 Appendix A - History

The Strategic Plan addresses the on-going and planned growth of the GIS Hub and other components of the GIS Initiative as envisioned by the North Dakota GIS Technical Committee (GISTC). The GISTC is composed of seven state agencies: Department of Transportation,

Department of Health, State Water Commission, Geological Survey, Parks and Recreation Department, Game and Fish Department, and the Information Technology Department.

Today, as part of the on-going GIS Initiative, the GIS Hub continues to have heavy use from state and other levels of government and from the public and private firms. State agencies primarily connect directly to the GIS Hub databases while other levels of government, the public, and private firms primarily view and download data through a web interface. These usage patterns drive the need to create additional applications and develop/upgrade data sets.

In mid-January 2000, North Dakota's Chief Information Officer (CIO) was contacted by two representatives from the GISTC asking that ITD study the need for a centralized GIS hosting service for North Dakota state agencies and their partners. The GIS Hub would provide a means of sharing the GIS information being stored locally at each agency. The CIO agreed that GIS is an important technology for state government and that ITD should take a lead role in GIS.

ITD retained a consulting firm to study how GIS was used in state government. The report's findings were presented to the GISTC, the Director of Office and Management and Budget, the Governor's Chief of Staff, and the Legislative IT Committee. At the request of the GISTC, the CIO agreed to request funding from the Legislature to fund the GIS Initiative. In April 2001 the Legislature provided funding to construct the GIS Hub, a database and web infrastructure hosted by ITD for hosting and sharing state agency GIS data and applications.

7.2 Appendix B - List of Acronyms

ANSI – American National Standards Institute: administers and coordinates the U.S. standardization and conformity assessment system

API – Application Programming Interface is a description of how data and information is stored in memory so that one computer system can interact with another.

ArcIMS – ESRI Internet Map Server: software that delivers maps and information through the Web

ArcSDE – ESRI Spatial Database Engine: software used to access spatial data stored in a relational database management system

DEM – Digital Elevation Model: digital representation of elevation consisting of a regular array of elevations of ground positions

DOQQ – Digital Orthophoto Quarter Quadrangle: digital image of an aerial photograph covered a quarter of a USGS mapping quadrangle. Each quarter quadrangle covers 3.75 minutes of latitude and 3.75 minutes of longitude.

ESRI – Environmental Systems Research Institute: software company based in Redlands, California which produces commercial GIS software.

FGDC – Federal Geographic Data Committee: responsible for coordinating the development, use, sharing, and dissemination of geospatial data across the nation

GIS – Geographic Information System: computer-based system used to manage and integrate spatial data, maps are a common by-product

GISTC – North Dakota GIS Technical Committee: consists of eleven state agencies acting as a clearinghouse of state GIS activities and responsible for disseminating spatial data

GNF – North Dakota Game and Fish Department

ISO – International Standards Organization: international organization who develops technical standards

IT – Information Technology: dealing with the use of computers and telecommunications

ITD – North Dakota Information Technology Department

MrSID – Multi-Resolution Seamless Image Database: image compression file format

NAD83 – North American Datum 1983: earth-centered elevation datum used as a basis for surveying and mapping

NAIP – National Agriculture Imagery Program: the program is administered through the Aerial Photography Field Office of the US Department of Agriculture (USDA) Farm Service Agency. NAIP imagery is intended to support USDA agriculture management programs.

NDDH – North Dakota Department of Health

NHD – National Hydrography Dataset: digital spatial data that contains information about surface water features such as lakes, ponds, streams, rivers, wells, and springs.

NSDI – National Spatial Data Infrastructure: technologies and policies used to promote sharing of geospatial data throughout government, administered by the FGDC

NSGIC – National States Geographic Information Council: national organization of states with a goal of efficient and effective government through effective use of geospatial information technologies

OGC – Open Geospatial Consortium: non-profit organization which leads the development of standards for geospatial and location-based services.

PLSS – Public Land Survey System: method for subdividing and describing land in the US. Regulated by the US Department of the Interior's Bureau of Land Management

P&R – North Dakota Parks and Recreation Department

SWC – North Dakota State Water Commission

USGS – U.S. Geological Survey

WFS – Web Feature Service: vector data (lines, points, polygons) delivered via the Web in an open standard format

WMS – Web Map Service: image data (aerial photography, scanned image, etc.) delivered via the Web in an open standard format